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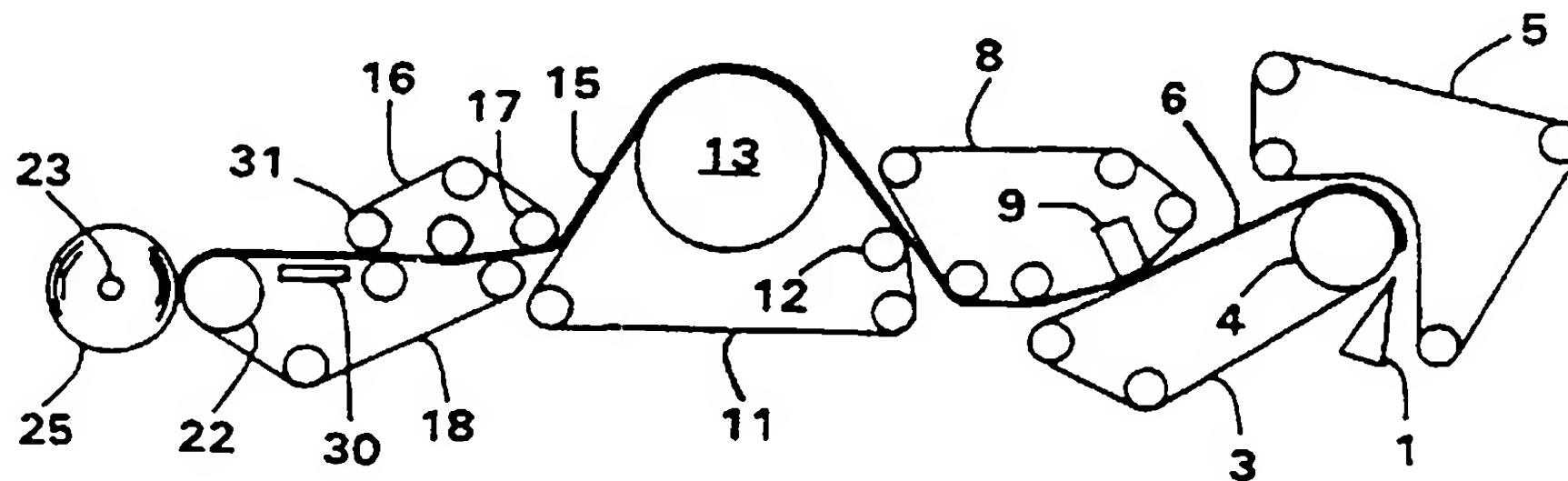
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(54) Title: METHOD FOR MAKING UNCREPED THROUGHDRIED TISSUE PRODUCTS WITHOUT AN OPEN DRAW



## (57) Abstract

A method for making uncreped throughdried tissues is disclosed in which the dried tissue sheet (15) is fully supported by a fabric sheet (18) up to the reel (23). This method eliminates the open draw between the throughdryer (13) and the reel (23) and thereby eliminates sheet breaks normally associated with such open draws. In addition, the machine direction strength of the sheet can be reduced since the added strength is not needed to traverse the open draw normally present in current processes. Reducing the MD strength in turn enables the production of more square, less stiff sheet, which improves the tactile properties of the product.

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### Summary of the Invention

It has now been discovered that in the manufacture of uncreped throughdried tissue sheets, the open draw between the throughdryer and the reel can be eliminated using an appropriate combination of dry end transfer fabrics and/or other transfer devices. In so doing, tissue sheets having much lower machine direction strengths can be made, thereby providing a means for making tissue sheets that are softer and more "square" in terms of the machine direction and cross-machine direction tensile strengths.

Hence in one aspect, the invention resides in a method for making an uncreped throughdried tissue comprising depositing an aqueous suspension of papermaking fibers onto a forming fabric to form a wet web, transferring the wet web to a throughdrying fabric, throughdrying the web to form a tissue sheet, and transferring the tissue sheet to a reel such that the sheet does not traverse an open draw while being wound onto the reel in the winding nip formed between the reel and a reel drum. Avoidance of the open draw can be achieved either by direct transfer of the tissue sheet from the throughdrying fabric to the reel drum or by an intermediate transfer to one or more dry end transfer fabrics. This method is particularly advantageous at high machine speeds (about 2000 or about 3000 feet per minute or greater) where a relatively high MD tensile strength is otherwise necessary for the sheet to pass to the reel without periodically breaking.

Hence in another aspect, the invention resides in the foregoing method wherein the tissue sheet is: (a) transferred from the throughdrying fabric to a first dry end transfer fabric using a vacuum roll; (b) carried between the first dry end transfer fabric and the top side of a second dry end transfer fabric having a relatively high degree of air permeability (about 200 cubic feet per minute per square foot or greater), the underside of which partially wraps around the reel drum; (c) transferred to the top side the second dry end transfer fabric and maintained thereon by air pressure created by an air foil positioned on the underside of the second dry end transfer fabric; and (d) wound onto the reel. More specifically, the air permeability of the second dry end transfer fabric can be from about 200 to about 500 cubic feet per minute per square foot, still more specifically from about 300 to about 400 cubic feet per minute per square foot. Air permeability, which is the

METHOD FOR MAKING UNCREPED THROUGHDRIED TISSUE PRODUCTS  
WITHOUT AN OPEN DRAW

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Background of the Invention

In the manufacture of tissue products such as facial tissues, bath tissues and paper towels, the tissue basesheets are generally produced by depositing an aqueous suspension of papermaking fibers onto a forming fabric, dewatering the suspension to form a web, drying the web, and winding the dried web into a roll for subsequent conversion into a particular product form. During manufacturing, most tissue webs are adhered to a steam-heated Yankee dryer and thereafter dislodged from the surface of the Yankee by contact with a doctor blade (creping) prior to converting to improve the softness and stretch of the sheet. More recently, soft uncreped throughdried tissue sheets have been disclosed in which the softness and stretch are built into the sheet by other processing methods.

However, in all such processes, the final sheet traverses an "open draw" before being wound into rolls, meaning that the dried sheet is momentarily unsupported before being wound. In the case of creped sheets, the sheet is dislodged from the creping cylinder and passed unsupported from the creping cylinder to the reel. For uncreped throughdried sheets, the sheet leaves the throughdrying fabric, or a subsequent transfer fabric, and also passes unsupported to the reel. As those in the tissue manufacturing business know, these unsupported runs or open draws are a source of sheet breaks and production delay time. To compensate, the tissue sheets are designed to have high machine direction strengths in order to remain intact during manufacturing. However, such high strengths are often counterproductive in terms of softness and are not desirable to the end user of the product.

Therefore, if open draws in tissue manufacturing could be eliminated, tissues could be made more efficiently from a waste-and-delay standpoint and the machine direction strength of the final product could be reduced to levels dictated solely by product requirements rather than manufacturing requirements.

(b) a continuous loop of a second dry-end transfer fabric positioned adjacent to the first dry-end transfer fabric such that the dried web is sandwiched between the first and second dry-end transfer fabrics, wherein said second dry-end transfer fabric loops around the reel drum and has an  
5 air permeability of about 200 cubic feet per minute per square foot or greater; and (c) an air foil positioned within the loop of the second dry end transfer fabric and adjacent to the second dry-end transfer fabric which creates air pressure to maintain the dried web in contact with the second dry-end transfer fabric.

10 In still a further aspect, the invention resides in the foregoing papermaking machine wherein the means for transferring the web from the throughdrying fabric to the reel comprises: (a) a continuous first dry-end transfer fabric positioned adjacent to the throughdryer fabric to enable transfer of the dried web to the first dry-end transfer  
15 fabric; (b) a continuous loop of a second dry-end transfer fabric positioned adjacent to the first dry-end transfer fabric such that the dried web is sandwiched between the first and second dry-end transfer fabrics, wherein said second dry-end transfer fabric loops around the reel drum and has an air permeability of about 100 cubic feet per minute  
20 per square foot or less.

In another aspect, the invention resides in the foregoing papermaking machine wherein the means for transferring the web from the throughdryer fabric to the reel comprises the reel drum being positioned adjacent to the throughdryer fabric sufficiently close to enable the  
25 dried web to be transferred to the reel drum.

In yet another aspect, the invention resides in the foregoing papermaking machine wherein the means for transferring the web from the throughdryer fabric to the reel comprises a vacuum drum positioned adjacent to the throughdrying fabric sufficiently close to enable the  
30 dried web to be transferred to the vacuum drum, said vacuum drum being positioned adjacent to the reel drum to enable the dried web to transfer from the vacuum drum to the reel drum.

These and other aspects of the invention will be described in greater detail in reference to accompanying the drawings.

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### Brief Description of the Drawing

Figure 1 is a schematic flow diagram illustrating a method for making uncreped throughdried tissue sheets in a manner representative of the prior art using an open draw prior to the reel.

5      Figure 2 is a schematic flow diagram of a method for making an uncreped throughdried tissue sheet in accordance with this invention utilizing an extended fabric having high permeability.

10      Figure 3 is a schematic flow diagram of a method for making an uncreped throughdried tissue sheet in accordance with this invention utilizing an extended fabric having low permeability.

Figure 4 is a schematic flow diagram of a method for making an uncreped throughdried tissue sheet in accordance with this invention utilizing a single drum to wind up the sheet directly from the throughdrying fabric.

15      Figure 5 is a schematic flow diagram of a method for making an uncreped throughdried tissue sheet in accordance with this invention utilizing two drums to wind up the sheet directly from the throughdrying fabric.

20      Figure 6 is a plot showing geometric mean tensile strength (GMT) per ply versus the MD tensile strength per ply for a variety of commercial facial tissues, bathroom tissues and towels, as well as several examples produced by the method of this invention.

### Detailed Description of the Invention

25      In describing the various figures herein, the same reference numbers are used throughout to describe the same apparatus. To avoid redundancy, detailed descriptions of much of the apparatus described in Figure 1 is not repeated in the descriptions of subsequent figures, although such apparatus is labelled with the same reference numbers.

30      Referring first to Figure 1, shown is a schematic flow diagram of a representative throughdrying process for making uncreped throughdried tissues. Shown is the headbox 1 which deposits an aqueous suspension of papermaking fibers onto inner forming fabric 3 as it traverses the forming roll 4. Outer forming fabric 5 serves to contain the web while  
35      it passes over the forming roll and sheds some of the water. The wet web 6 is then transferred from the inner forming fabric to a wet end transfer fabric 8 with the aid of a vacuum transfer shoe 9. This transfer is preferably carried out with the transfer fabric travelling at a slower

TABLE 1

		MD Tensile	MD Stretch	CD Tensile	CD Stretch	GMT
5	1-A	333	15	185	8.9	248
	1-B	388	16	199	9.8	277
	1-C	535	18	289	12.6	389
	1-D	560	18.5	249	9.9	373
10	1-E	805	20	466	10.9	612

This data is represented as points A-E in Figure 6. It illustrates the ability of this invention to commercially produce and wind tissue webs of low strength.

15 It will be appreciated that the foregoing examples, given for purposes of illustration, are not to be construed as limiting the scope of this invention, which is defined by the following claims and all equivalents thereto.

20

## We claim:

- 5 1. A method for making an uncreped throughdried tissue comprising depositing an aqueous suspension of papermaking fibers onto a forming fabric to form a wet web, transferring the wet web to a throughdrying fabric, throughdrying the web to form a tissue sheet, and transferring the tissue sheet to a reel such that the sheet does not traverse an open draw while being wound onto the reel in the winding nip formed between the reel and a reel drum.
- 5 2. The method of Claim 1 wherein the tissue sheet is: (a) transferred from the throughdrying fabric to a first dry end transfer fabric using a vacuum roll; (b) carried between the first dry end transfer fabric and the top side of a second dry end transfer fabric, the underside of which partially wraps around the reel drum; (c) transferred to the top side the second dry end transfer fabric and maintained thereon by air pressure created by an air foil positioned on the underside of the second dry end transfer fabric; and (d) wound onto the reel.
3. The method of Claim 2 wherein the air permeability of the second dry end transfer fabric is about 200 cubic feet per minute per square foot or greater.
4. The method of Claim 2 wherein the air permeability of the second dry end transfer fabric is from about 200 to about 500 cubic feet per minute per square foot.
5. The method of Claim 2 wherein the air permeability of the second dry end transfer fabric is from about 300 to about 400 cubic feet per minute per square foot.



- 5
6. The method of Claim 1 wherein the tissue sheet is: (a) transferred from the throughdrying fabric to a first dry end transfer fabric using a vacuum roll; (b) carried between the first dry end transfer fabric and the top side of a second dry end transfer fabric, the underside of which partially wraps around the reel drum; (c) transferred to the top side the second dry end transfer fabric; and (d) wound onto the reel.
  7. The method of Claim 5 wherein the air permeability of the second dry end transfer fabric is about 100 cubic feet per minute per square foot or less.
  8. The method of Claim 5 wherein the air permeability of the second dry end transfer fabric is from about 25 to about 100 cubic feet per minute per square foot.
  9. The method of Claim 5 wherein the air permeability of the second dry end transfer fabric is from about 50 to about 100 cubic feet per minute per square foot.
  10. The method of Claim 1 wherein the tissue sheet is transferred directly from the throughdrying fabric to the reel drum and wound onto the reel.
  11. The method of Claim 1 wherein the tissue sheet is transferred directly from the throughdrying fabric to a first reel drum, thereafter immediately transferred to a second reel drum, and wound onto the reel.
  12. The method of Claim 1 wherein the speed of the tissue sheet is about 2000 feet per minute or greater.
  13. The method of Claim 1 wherein the speed of the tissue sheet is about 3000 feet per minute or greater.

- 15 (c) an air foil positioned within the loop of the second dry end transfer fabric and adjacent to the second dry-end transfer fabric which creates air pressure to maintain the dried web in contact with the second dry-end transfer fabric.
16. The papermaking machine of Claim 1 wherein the means for transferring the web from the throughdrying fabric to the reel comprises:
- 5 (a) a continuous first dry-end transfer fabric positioned adjacent to the throughdryer fabric to enable transfer of the dried web to the first dry-end transfer fabric; and
- 10 (b) a continuous loop of a second dry-end transfer fabric positioned adjacent to the first dry-end transfer fabric such that the dried web is sandwiched between the first and second dry-end transfer fabrics, wherein said second dry-end transfer fabric loops around the reel drum and has an air permeability of about 100 cubic feet per minute per square foot or less
17. The papermaking machine of Claim 1 wherein the means for transferring the web from the throughdryer fabric to the reel comprises the reel drum being positioned adjacent to the throughdryer fabric sufficiently close to enable the dried web to be
- 5 transferred to the reel drum
18. The papermaking machine of Claim 1 wherein the means for transferring the web from the throughdryer fabric to the reel comprises a vacuum drum positioned adjacent to the throughdrying fabric sufficiently close to enable the dried web to be transferred
- 5 to the vacuum drum, said vacuum drum being positioned adjacent to the reel drum to enable the dried web to transfer from the vacuum drum to the reel drum.

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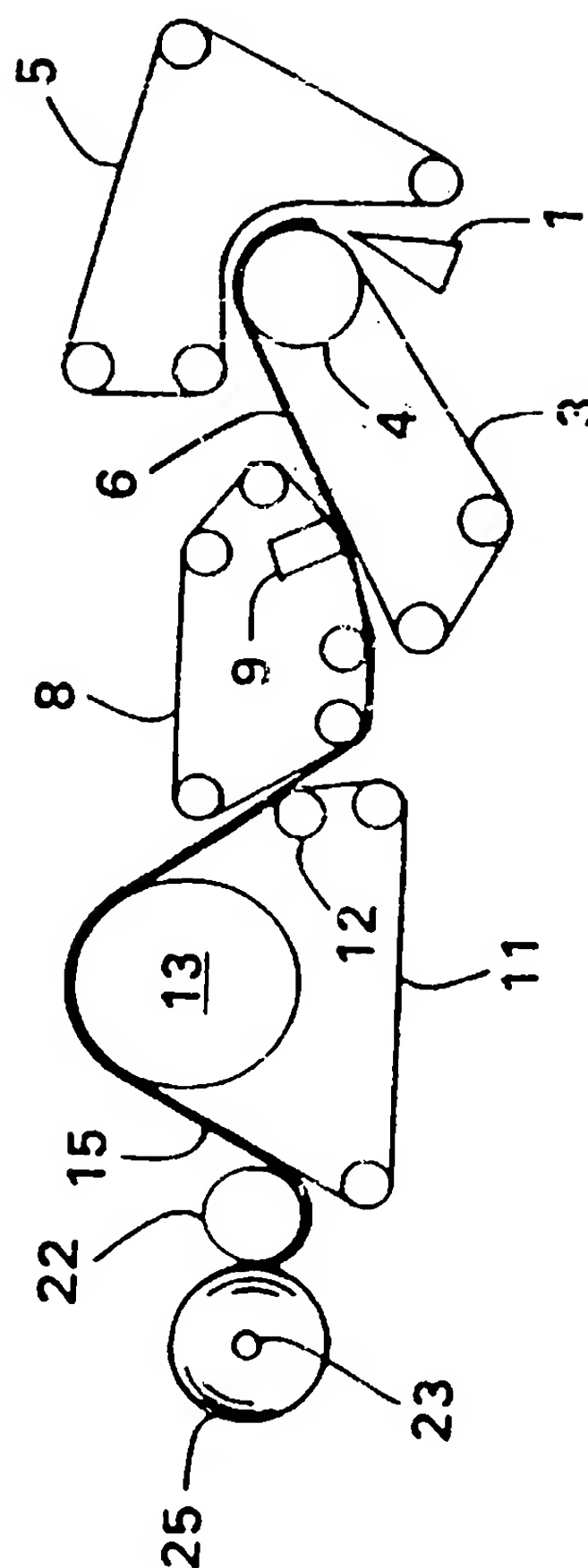


FIG. 4

# INTERNATIONAL SEARCH REPORT

International Application No  
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# INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US,A,4 440 597 (E.R. WELLS, T.A. HENSLER)  3 April 1984  see column 12, line 13 - line 17; figure 9  -----</p>	11,18